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ABSTRACT

This training manual provides information needed to meet the minimum EPA standards for certification as a commercial applicator of pesticides in the ornamental and turf pest control category. The text discusses pest control of ornamental plants, lawn diseases, and lawn weeds and their control. (CS)

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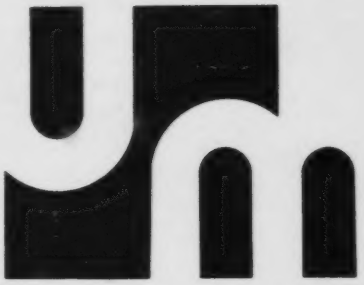

ORNAMENTAL/TURF PEST CONTROL

manual 89

This manual was developed in cooperation with The Missouri Department of Agriculture and the Coop Extension Service, University of Missouri.

Assembled by Members of Extension Pesticide Training Team

SE 024 666

Ornamental and Turf Pest Control

for Commercial Applicators

CONTENTS:

Pest Control of Ornamental Plants*

NCR 12, Lawn Diseases in the Midwest

NCR 26, Lawn Weeds and their Control

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FORWARD

This training manual is intended to provide information needed to meet the minimum standards of the Environmental Protection Agency. It is also intended to prepare you to take an examination for commercial applicator certification given by the Missouri Department of Agriculture based on this manual. This training will not provide all the information needed for effective Ornamental and Turf Pest Control. Additional information in the form of publications and short courses can be obtained from the University Extension Centers.

PEST CONTROL OF ORNAMENTAL PLANTS

Pest control of ornamental plants presents several unique problems. Many of these problems are created by the close proximity of people to the areas treated. To avoid problems as much as possible, the following safety precautions should be followed:

1.) Double check to make sure you have the correct yard before spraying.

2.) Do not allow children or pets to remain in the area being sprayed.

3.) Check neighbors' yards to make sure there are no children or pets around who could come in contact with possible spray drift.

4.) Remove children's toys.

5.) Be sure all clothing is removed from area.

6.) Avoid spraying lawn furniture.

7.) Make sure all house windows are closed.

8.) Turn over pet dishes.

9.) Avoid fish ponds, bird baths and bird feeders.

10.) Observe pesticide label restrictions concerning tolerance for fruits and vegetables.

11.) Sweep or flush away all spray puddles.

12.) Secure all pesticide containers on spray apparatus before moving.

The wide diversity of plants grown in the landscape also causes problems. Unrelated plants are often grown side by side. When spraying, the applicator needs to be aware of problems that may be caused by spray injury to nearby plants. Shrubs and ground covers, for example, may be injured by weed killers applied to adjacent turf areas. Other examples of injuries that may be caused by careless spraying are as follows:

Carbaryl (Sevin) injuries - Boston Ivy.

Bordeaux Mixture may injure certain succulent plants.

Chlorobenzilate may damage hydrangea.

Demeton (Systox) will defoliate Bechtel's double flowering crab.

Diazinon injures ferns, hibiscus, gardenias, stephanotis, and African violet.

Dimethoate (Cygon) causes defoliation of honeylocust and elm. It may also injure flowering almond, dahlias, plum, peach, cherry, chrysanthemum, or Chinese holly.

Ethion will injure yews or redbud.

Lead Arsenate may defoliate Viburnum carlesi, forsythia and flowering peach.

Malathion injures canaert, sargent's and burk junipers, Japanese holly, ferns, violets, petunias, and the rose varieties Caledonia and Talisman.

Oil sensitive plants include beech, black walnut, butternut, hickory, mountain ash, Japanese maple, red maple, sugar maple, yellow wood, Russian olive, Norway spruce, yews, hemlock, magnolias, redbud, broadleaved evergreens in general and junipers.

Ovex (Ovotran) is toxic to azaleas, beech, boxwood, barberry, deutzia, hollies, raspberry, oak, hawthorn, spruce, and sycamore.

Phorate (Thimet) distorts new growth of Eleyi crab apple trees.

Phosphamadin causes defoliation of thornless honeylocust.

Sulfur is toxic to viburnums and forsythia.

Tedion (tetradifon) may injure some varieties of roses.

Thiodan (endosylfan) may injure geraniums.

Toxaphene will injure linden, oak, redbud, sugar maple, plum, grape, peach, and pear trees.

The above list makes apparent the troubles that can arise when careless application allows sprays to drift onto nearby plants.

The wide spectrum of ornamental plants being grown in the landscape also presents problems because no pesticide may be used on all plants. The pesticide label will contain a list of plants that can be treated. Since the registration status of pesticides is continuously being reviewed and is subject to change, read the product label before purchasing to make sure it is registered for your need. To use the product in any way that is inconsistent with the label is a violation of the Federal Environmental Pesticide Control Act of 1972.

The customers of ornamental pest control applicators generally have little if any experience in growing plants. Therefore, the applicator must be able to diagnose as well as treat the problem. Proper diagnosis often depends on a knowledge of the natural growth patterns of a plant. Knowing what a normal plant should look like is often necessary in determining the cause of a plant problem or in some cases determining if a problem exists.

Many plant problems are not associated with insect or diseases but are the result of some other environmental factor. These problems, often referred to as non-parasitic problems, may cause direct injury to a plant or by weakening the plant they may make it more susceptible to insect or disease attack. Some examples of non-parasitic problems include, nutrient deficiencies, chemical toxicity, air pollution, spray injury, mechanical damage, drought injury including leaf scorch, construction injury and winter injury.

Diagnosing non-parasitic problems often requires a knowledge of the past history of the plant. This includes when and how planted, construction activities in the area, climatic conditions and any other factors that might influence plant growth. The condition of surrounding plants will often give clues that may be helpful in diagnosing a problem.

Determining if a problem is caused by insects, disease or non-parasitic factors may be difficult. Dead spots in leaves which are caused by fungus diseases are usually regular in outline and vary in shades of color on the outside edges. Small black fungus bodies on the dead tissue sometimes help identify the problem. Non-parasitic injury is generally irregular in shape and uniformly colored. Numerous tiny bleached spots on the leaf result from leaf hoppers or spider mites feeding on the foliage. These spots may be close enough together to give the entire leaf a yellow or bleached appearance. A uniform yellow color with veins and midrib remaining green is more likely caused by mineral deficiency.

Leaf curl or distortion that appears as tightly rolled or curled leaves is usually caused by aphids. Leaf distortion that appear as cupped foliage, distorted leaf shape or marginal chlorosis are generally caused by herbicide injury.

Sunken areas in the bark indicates injury to tissue beneath. If the wood beneath the bark shows a gradual change in color from damaged to healthy tissue the problem is probably caused by disease. If the change in color is abrupt a non-parasitic cause is more likely.

Root problems are the most difficult type of disorder to diagnose. Sudden death of a tree may result from disease, construction injury, rodent damage or toxic chemicals. Progressive weakening over a period of years may be due to girdling roots, decay, poor drainage, lack of nutrients, changes in grade or planting too deep.

In addition to being able to diagnose a problem it is also necessary to be able to estimate the potential damage it may cause. For example, defoliation of a shade tree late in the growing season may look serious but actually does little harm to the plant other than detract from its' appearance. The same type of injury early in the growing season would limit the current season's growth and several successive defoliations could seriously damage the tree. Conifers are an exception, extensive defoliation at any time of the year will seriously injure the plant and complete defoliation will kill them.

Applying treatments at the right time is an essential part of any pest control program. Insects that feed on foliage by chewing or sucking should be sprayed when they are present and active on the host. Gall producing insects and borers must be prevented by protective sprays to prevent adults from laying eggs. Scale insects can be controlled at other times of the year but they are most vulnerable when they are in the crawler stage. Diseases must be prevented by applying protective sprays before the plants become infected. When the damage from a disease becomes evident it is usually too late to spray.

Successful treatment of ornamental plant problems is based on proper identification, assessment of potential severity, selection of the proper methods of treatment, and applying the treatments at the proper time. The following section was prepared as an aid in diagnosis and treatment of problems on some of the more common ornamental plants. It is not a complete listing of all problems that might occur on these plants, but it does include the more common ones.

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
ARBORVITAE	Diseases			
	Phomopsis Needle and Twig Blight (fungus)	Serious in wet seasons. Needles, twigs, and smaller branches turn brown to reddish-brown; gradually die back from tips. Tiny small black dots appear later on infected parts. May be confused with normal fall browning, winter injury, spider mites, etc.	Prune and or remove blighted plants. Spray at budbreak and at 10 to 14 day intervals.	Benlate
	Winter Injury (non-parasitic)	Foliage turns brown and die back from tips and margins. In severe cases entire plants may die suddenly in late winter or early spring.	Late fall watering to insure plants have adequate water during winter helps prevent damage. Fertilize in spring to help overcome damage. Remove dead wood after growth starts in spring.	
	Insects			
	Bagworm	Brownish larvae in tough, silken, pendent-like bags feed on needles. Overwinters in egg stage in female bags on host. Eggs hatch in late May or early June.	Treat in early June when larvae are small.	carbaryl (Sevin) diazinon toxaphene malathion chlorpyrifos (Dursban)
	Spider Mites	Small, greenish to reddish, eight legged mites that suck sap from needles and cause yellowing of plants.	Check for mites. May be present in early June.	dicofol (Kelthane) malathion Dursban Zectran

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
ASH	Diseases			
	Anthracnose (fungus)	Large irregular brown spots, mostly along leaf margins.	Collect and remove fallen leaves. Disease not usually serious enough for fungicidal control except in unusually wet seasons or in locations where air drainage is restricted. Spray when leaves are half grown. Second application 10-14 days later, third only under extremely wet conditions.	Benlate Bordeaux Mixture Kocide 101 Zineb
	Rust (fungus)	Swollen, distorted, gall-like formations on leaves and twigs. Can be confused with insect galls.	Usually not a problem unless host is near alternate host - marsh or cord grasses. Control measures usually not needed, but destroying alternate host will help.	
	Insects			
	Aphids	Small, bluish-black, winged or wingless, cause clumping of leaves at tip of new growth. Usually large quantity of white, fluffy, wax-like material over the deformed leaf clump.	If present, will be usually on young trees.	malathion Dursban
	Ash Flower Gall Mite	Tiny, light colored mites feeding in the male flowers cause gall-like formation of flowers. Flowers later turn black and remain on tree over winter.	Best results with 2% dormant spray oil. Galls do not seriously damage plant but very unsightly.	superior oil (70 second) Zectran Di-Syston

	Oyster Shell Scale	Bark sometimes covered with brownish-gray scales resembling minature oyster shells. Small, soft, yellowish insects or whitish eggs beneath the scales. There is one generation of the scale each year. Winter is passed in the egg stage.	Usually very difficult to control. Thorough spray coverage essential. Use spray oil as dormant spray. Other insecticides can be used against the crawlers in late May and a second application 10 days later.	superior oil (70 second) diazinon malathion Zectran
	Lilac Borer	Adult a brownish wasplike moth about one inch long. Adults emerge in late May to mid-June and lay eggs on rough bark of the tree. Larvae bore at crown and in stem of Ash.	Very difficult to control. Apply spray to crown and trunk. Three applications two weeks apart beginning in late May. Borers seldom attack healthy trees. Keeping trees in a vigorous condition will help prevent them.	lindane Thiodan
BIRCH	<u>Diseases</u>			
	Anthracnose (fungus)	Small, irregular, circular brown spots with dark margins.	Follow directions as for Ash anthracnose.	
	Canker (fungus)	Ridges of bare wood are exposed to infection. Sometimes "target" effect.	Remove and destroy cankered branches. Treat pruning wounds with approved tree paint.	
	Leaf Yellowing	Leaves turning yellow throughout crown of tree and falling prematurely.	Caused by leaves losing water faster than it is taken up. Water and mulch trees.	
	<u>Insects</u>			
	Birch Leafminer	Whitish larvae of this sawfly up to $\frac{1}{4}$ inch long feeding between the leaf surfaces. Overwinters as pupa in soil. Usually two generations per season.	Make application in late May. A second spray application may be needed in late June.	carbaryl (Sevin) lindane malathion

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
BIRCH (Cont.)	Insects (Cont.)			
	Bronzed Birch Borer	Adult beetle, blackish with greenish-bronze hue, ¼ to ½ inch long 1/10 to 1/8 inch wide. Larva white ½ to 5/8 inch long with the thorax portion slightly enlarged. Overwinter as larva in tree. One generation per year.	White birch usually most seriously injured. Most numerous in northern states. Three spray applications usually necessary late May, mid-June, late June.	lindane
CATALPA	Diseases			
	Leaf spots (fungus) Spot Anthracnose (fungus)	Round to irregular, yellowish-brown to black spots. Spots may drop out, leaving holes.	Collect and remove fallen leaves. No chemical control can be recommended.	
	Powdery Mildew (fungus)	Powdery white patches on leaves. If severe, leaves may wither and drop early.	Collect and remove fallen leaves. If severe, spray weekly or bi-weekly when mildew appears.	Benlate Karathane Wettable Sulfur
	Verticillium Wilt	Leaves on one or more branches wilt, turn brown, hang downward and drop early. Purple to bluish-brown streaks in sapwood under bark.	Cut and remove severely infected trees. Where only 1 to 6 limbs are dead or show wilt, prune affected parts. Disinfect tools, and use wound dressings. Fertilize heavily in early spring to encourage vigorous growth.	
	Insects			
	Catalpa Sphinx	Caterpillars up to 3 inches long, black with dark greenish stripes, black horn on terminal end of body, feed on leaves. One to two generations per year. Overwinter as pupae in soil.	Defoliation usually too late in season to cause serious damage to established trees.	Sevimol

COTONEASTER	Diseases			
	Fire Blight (bacteria)	General and serious. New shoots suddenly appear as if scorched by fire. Leaves cling to twigs. Cankers on twigs and branches may be present.	Prune out blighted parts dormant season (late summer or fall) or when weather is dry. Dip pruning tools in 70% alcohol or household bleach solution between cuts. No chemical control recommended.	
	Insects			
	Hawthorn Lacebug	Adults, dark brown with clear areas near tips of lacy wings. Feed on underside of leaves. Overwinter as adults, one generation per year.	Treat when noted on leaves.	lindane malathion carbaryl (Sevin)
	San Jose Scale	Yellow, soft bodied insects, on the surface of the bark, covered by a grayish shield-like scale, with a dark ripple near the center. Overwinters as partially grown nymphs. Reach maturity about apple blossom time. There are 2 to 6 generations per year.	Dormant spray oil in early spring. Crawler sprays should be applied when crawlers appear, usually mid to late June.	superior oil (70 second) carbaryl (Sevin) Sevimol Zectran
	Spider Mites	See Arborvitae.		
CRAB APPLE (ornamental)	Diseases			
	Fire Blight (bacteria)	General and serious. New shoots appear as if scorched by fire. Leaves cling to twigs and have "shepherd's crook" appearance.	Do routine pruning in late summer or fall, not in spring, but cut out at once any diseased branches and twigs found during the growing season. Cut 12 to 18 inches below visible infected area. Disinfect pruning tools in solution of household bleach (1 part in 9 parts water) or 70% alcohol or formaldehyde.	Streptomycin (not recommended for home use)

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
CRAB APPLE (Cont.)	Diseases (Cont.)			
	Scab (fungus)	Serious in wet seasons. Dull, velvety spots on leaves. May also appear on flower parts and fruit.	Collect and remove fallen leaves in autumn. Follow regular spray program starting from time when first leaves appear until petal fall, at 6 - 7 day intervals, then at 10 - 14 day intervals for remainder of season.	Benlate Captan Folpet Mancozeb
	Powdery Mildew (fungus)	Whitish powdery patch on young leaves, buds, blossoms and twigs.	When common follow apple spray schedule as under apple scab.	Benlate Dinocap Dikar Sulfur
	Cedar-Apple Rust (fungus)	Pale yellow-orange spots on upper leaf surfaces. "Cluster cups" on underside of leaf spots.	Follow regular apple spray schedule when serious on susceptible varieties.	Ferbam Thiram Zineb Mancozeb
	Insects			
	Aphids	Soft bodied insects, winged and wingless. Suck sap from plants. Life cycle varies for species involved.	Treat when aphids are present.	diazinon Dursban Guthion lindane malathion
	Leafhoppers	Small, elongated, greenish or whitish jumping insects that suck sap from leaves. Life cycle varies with species.	Treat when leafhoppers are present in damageing numbers.	carbaryl (Sevin) Guthion methoxychlor Dursban diazinon
	Round Headed Apple Tree Borer	White, legless caterpillar bores into trunk of tree near ground line. Frass, extruded from tunnel. Adult brownish, long horned beetle with two white stripes on wing covers. Usually a complete life cycle in 3 years.	Wrap trunk of newly planted trees, with heavy wrapping paper. Treat lower trunk with spray in early June and make second application in July on trees not wrapped.	lindane
	Spider Mites	See Arborvitae.		

DOGWOOD	Diseases			
	Botrytis Petal Blight (fungus)	Common in wet springs. Irregular brown areas in fading flowers and leaves. May be covered with gray mold in wet weather.	Apply fungicide just before, during and after bloom. If possible, just before wet periods.	Benlate Captan
	Spot Anthracnose (fungus)	Common in wet seasons. Spots of various sizes, shapes and colors, often with dark purple to brown borders.	Apply same fungicides as for Botrytis petal blight on same schedule. Seldom permanently damages tree.	
	Canker	A general lack of vigor. Leaves smaller and lighter green than normal, may dry and shrivel during dry periods. Caused by a canker at or near the soil level or on main roots.	Cankers can be cut out if they are not too large. Paint cut areas with tree paint. Cankers are associated with wounds. Avoid or treat wounds to aid in prevention.	
	Insects			
	Dogwood Borer	Larva white, feeds in bark for time then enters tree causing swollen area on trunk at or below ground surface. Adult clear wing moth. Overwinter as larva.	Wrap trunk of newly transplanted trees with heavy paper. If spray is used, apply to trunk in late May and again 3 weeks later.	lindane
ELM	Diseases			
	Anthracnose (fungus)	Irregular brown spots or areas between veins and margins.	Same as Ash anthracnose.	
	Black Leafspot (fungus)	Small, irregular spots that become shiny, tan-black and raised.	Same as Ash anthracnose.	
	Dutch Elm Disease (fungus)	Leaves wilt, turn yellow and brown in terminal parts of tree first; later entire tree. Brown discoloration occurs in sapwood just under bark in wilting branches. Positive identification requires laboratory culturing.	Cut and remove diseased trees. For protection of valuable trees, a program of annual spraying with insecticide and fungicide may have some value under certain circumstances. Therapy for infected trees is still questionable. Program should include:	Benlate

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
ELM (Cont.)	Diseases (Cont.)		(1) Vector control (insecticide) for bark beetles. (2) Control of root grafts. (3) Foliage spray with fungicide in spring at early full leaf. (4) Therapy through trunk or branch injections of Benomyl - gravity or pressure. Only by arborists trained in this technique.	
	Phloem Necrosis (mycoplasma)	During June and July, leaves roll upward, turn yellow or brown, wither and drop prematurely. Death of tree fairly quick. Inner bark, near trunk base, yellow to butterscotch-colored.	Infected trees cannot be cured. Use Vector control (insecticide) for leaf hoppers.	
	Wetwood (slime flux) (bacteria)	Dark-colored sap (flux) flows from branch stubs, split crotches, trunk cracks or other bark wounds.	Fertilize and water to stimulate vigor. Repair bark wounds promptly. Trees may need drain pipes installed.	
	Insects			
	Smaller European Elm Bark Beetle	White, legless larvae overwinters in or under bark of recently killed and dying elm. Adults emerge in April and August. Vector for Dutch Elm Disease.	Spray high value elms and remove and destroy dead elms.	methoxychlor
	Elm Leaf Beetle	Adults overwinter. Approximately ¼ inch long, yellowish-green, dark stripes on wing covers. Larvae up to ½ inch long dull yellow color with two black stripes, on elm leaves in June.	Check for larvae in early June. Spray when they are present. A second brood of larvae in late July.	carbaryl (Sevin) diazinon methoxychlor

EUONYMOUS	Diseases			
	Crown gall (bacteria)	Common and serious. Rounded galls with irregular rough surfaces on roots and stems.	Avoid wounding stems or roots. Prune out and burn affected plant parts. Dig up and burn severely affected plants.	
	Powdery Mildew (fungus)	White powdery, moldy patches on leaves.	Remove badly affected shoots. Prune to thin out. Spray with fungicide when mildew appears.	Actidione PM Benlate Karathane Wettable Sulfur
	Insects			
	Euonymus Scale	Small, yellow, soft bodied insects under shield-like scale on stems and leaves. Males under oblong white scale. Crawlers in late May and late July.	Prune and destroy heavily scale incrusted stems. Apply dormant oil in early spring. Other sprays are for crawler control.	superior oil (70 second) carbaryl (Sevin) malathion Zectran
FIR	Diseases			
	Needle Cast and Twig Blight	General and serious, especially on young trees. Brown specks or bands on needles. Needles have faded color, often from tip downward. Drop early.	Collect and remove fallen needles. Prune and remove dead twigs. Fertilize and water to maintain vigor. Spray with fungicide when new growth is $\frac{1}{4}$ emerged; repeat 2, 4, and 6 weeks later.	Benlate Bordeaux Mix Maneb
	Insects			
	Bagworms	See Arborvitae.		
	Pine Needle Scale	Overwinters as purplish eggs under grayish white oyster shell-like scales of needles.	Use dormant spray oil in early spring. Use other listed insecticides against crawlers in late May.	superior oil (70 second) diazinon carbaryl (Sevin) malathion

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
HACKBERRY	Diseases			
	Powdery Mildew (fungus)	Powdery, white growth on both leaf surfaces.	When mildew appears, apply fungicide.	Actidione PM Benlate Karathane Wettable Sulfur
	Witches-broom (fungus)	Widespread. Unsightly clusters of dwarfed twigs. Twig dieback.	Cut off clusters back to healthy wood. Fertilize to stimulate vigorous growth. Dormant time -sulfur spray may be helpful.	
	Insects			
	Hackberry Nipple Gall (Psyllid)	Unsightly nipple-like growth on under surface of leaf. Grayish-black, jumping adults, emerge in September and in October, overwinter. Eggs on new stem growth and leaves in early May.	Treat in early May.	lindane
HAWTHORN	Diseases			
	Cedar-Hawthorn Rust (fungus)	Widespread. Pale yellow-orange spots on leaves.	Same as Cedar-apple rust of Crab Apple.	
	Insects			
	Aphids	Some species under leaves. One species causes rosette of leaves. One species feed in clusters on branches.	Treat when needed.	malathion diazinon Dursban Dibrom
	Lace Bug	Small lacy-winged insects suck sap from underside of leaves. Somtimes cause leaf yellowing and premature leaf fall.	Treat when present - usually in late May.	lindane malathion carbaryl (Sevin)
	Scurfy Scale	Soft bodied insects under pear shaped, dirty white shields. Male scale long, white. Overwinters as purplish eggs under shield. One generation per year.	Use dormant oil in early spring. Other materials against crawlers in late May.	superior oil (70 second) malathion carbaryl (Sevin)

HOLLY	Diseases			
	Anthracnose (fungus)	Round to irregular spots of various sizes on leaves. Many colors, from yellow to brown with brown to purplish margins.	Pick and remove spotted leaves, where practical. Spray with fundicide in late spring and continue at 10 to 14-day intervals.	Benlate Mancozeb
	Spine Spot (non-parasitic)	Small, grayish-brown to dark red punctures and scratches on both leaf surfaces in early spring.	Spots caused by wounding of leaves by spines of nearby leaves during windy conditions. Use anti-desiccants. Plant in sheltered locations or erect wind barriers.	
	Leaf Scorch (non-parasitic)	Irregular, scorched areas on leaves, especially near margins.	Same as for Spine Spot.	
	Winter Injury (non-parasitic)	Foliage brown and scorched. Twig dieback. Bark splitting.	Same as for Spine Spot.	
	Insects			
	Holly Leaf Miners	Puparia in larvae leaf-blotch mine, in spring. Small black fly about mid-May lays eggs in new leaves.	Use insecticide when adults are present, about mid-May.	diazinon Dylox
HONEY LOCUST	Diseases			
	Anthracnose and Leaf Blights (fungi)	General in wet seasons. Round to irregular spots and blotches on leaves and pods.	Collect and remove fallen leaves. Prune out dead twigs and weak wood to increase air circulation. If practical, spray with fungicide as buds begin to unfold and 10 and 20 days later. Use same materials as for Ash anthracnose.	
	Insects			
	Mimosa Webworm	Steel gray moth lays eggs in June. Dark greenish-black larvae web leaflets together. Browning of leaves in July. Serious browning by second generation larvae in August. Overwinters as pupa in protected places.	Check for first signs of foliage browning, usually July. Use sufficient spray pressure to drive spray into webbing.	carbaryl (Sevin) diazinon lead arsenate

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
HONEY LOCUST (Cont.)	Insects (Cont.)			
	Honey Locust Pod Gall	Developing leaflets become galls with white legless maggots within. May be present any time new growth starts.	No insecticide labeled for use against the pest.	
IVY	Diseases			
	Leaf Spots (fungi) Twig Blight (fungi)	Small to large, round to irregular spots of various colors on leaves and stems.	Where practical pick and remove affected plant parts. Fungicide sprays usually not needed. Same materials as for Ash anthracnose may be used.	
	Insects			
	Leafhoppers	Several species of these small, green-reddish or brownish jumping insects, suck sap from the leaves.	Apply spray when leafhoppers are seen on plants.	methoxychlor Dursban Zectran
JUNIPER	Diseases			
	Phomopsis Needle and Twig Blight	See Arborvitae.	Same as Arborvitae.	
	Insects			
	Bagworm	See Arborvitae.		
	Juniper Tip Midge	Tips of twigs dry and turn brown. Tiny fly larvae inside tip cause the damage.	Spray about mid-May, June 20 and early August.	Cygon
	Juniper Webworm	Small, light brown larva, with parallel stripes on body, webs foliage together. Overwinters in the web. Feeds again in spring and matures about June 1.	Spray about May 1 and if needed in late September.	diazinon Dylox Sevimol
	Spider Mites	See Arborvitae.		

LILAC	Diseases			
	Powdery Mildew	General, unsightly, but not serious. Grayish-white mold patches on leaves from midsummer on. Especially in shaded areas.	Apply fungicide when mildew appears at 10-day intervals.	Benlate Karathane
	Shoot Blights (bacterial & fungal)	Common and severe in wet springs on shaded or crowded plants.	Prune annually for good air circulation. Prune out blighted portions. Disinfect tools. Avoid overfertilization with nitrogenous materials. Control borers. When needed apply fungicide as leaves begin to unfold.	Bordeaux Fixed Copper
	Verticillium Wilt (fungus)	Leaves become pale, wilt and fall early, starting at base and spreading upward. Stems show brownish-green streaks under bark. Branch dieback.	Dig up and remove infected plants, roots and all. Avoid replanting in same spot for 5 - 6 years without drenching soil with soil fumigants.	
	Insects			
	Lilac Borer	White larvae with brown heads bore into larger stems near soil level. Adult a brownish wasp-like moth. In late May and June.	Treat large stems in late May or early June and again 3 weeks later.	lindane Thiodan
	Oyster Shell Scale	See Ash.		
LINDEN (Basswood)	Diseases			
	Anthracnose, Leaf Blotch, Leaf Spots (fungi)	General in wet seasons. Small to large, round to irregular light brown spots with darker margins.	Prune out and remove dead and infected plant parts. When serious, spray with fungicide as buds start to swell. Repeat two times at 10-day intervals.	Bordeaux mix. Fixed Copper.
	Powdery Mildew (fungus)	General. Powdery, grayish-white mold on leaves and young shoots.	Where serious, spray twice when mildew develops.	Benlate Wettable Sulfur

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
LINDEN (Cont.)	Insects			
	Fall Webworm	Woolly, grayish caterpillars in tentlike webs, usually toward tips of limbs, in June and August. Moth white with small scattered black spots.	Destroy by hand or if many webs, spray in June and in early August.	methoxychlor malathion toxaphene
	Scurfy Scale	See Hawthorn.		
MAPLE	Diseases			
	Anthracnose, Tar Spot, Zonate Leaf Spot (fungi)	General in wet seasons. Small to large, round to irregular, light to reddish-brown areas on leaves. Small to large round, yellowish-gray or shiny black spots.	Same as Ash anthracnose.	
	Verticillium Wilt (fungus)	Very destructive. Leaves suddenly discolor and wilt on one or more limbs, usually in midsummer. Olive-green to brown streaks in sapwood.	Same as Catalpa--Verticillium wilt.	
	Maple Decline (cause undetermined)	Trees decline in vigor. Foliage thin and weak. Leaves turn yellow, wither and fall early.	Maintain vigor with fertilization in spring, watering during moisture stress. Other cultural measures to promote vigor.	
	Insects			
	Aphids	Plant lice feed on leaves.	Treat when numerous.	diazinon malathion Dursban Zectran
	Borers	Larvae bore into trunk at or near ground line.	Wrap trunks of young plants for two years after transplant with wrapping paper. Prevent mechanical injury. Spray lower trunk of unwrapped trees in late June.	lindane

MAPLE (Cont.)	Insects (Cont.)			
	Maple Bladder Gall Mite	These mites overwinter in bud scars and under bark. Move to developing leaves in spring and cause the green, red, and black blister-like leaf galls on the upper surface.	Apply spray when leaves are about ½ expanded. Seldom causes serious damage.	Spectricide Zectran Dursban
	Cottony Maple Scale	Overwinter as nymphs under scale. Female matures and deposits mass of eggs. White "cotton" wax covers eggs. Yellow crawlers usually by early June.	Spray when crawlers are present.	carbaryl (Sevin) diazinon Zectran
MIMOSA	Diseases			
	Fusarium Wilt (fungus)	Leaves turn yellow, wilt, shrivel, and hang downward on one or more branches. Brown streaks under bark.	Cut and remove seriously affected trees. Wilt-resistant strains available.	
	Insects			
	Mimosa Webworm	See Honey Locust.		
MOUNTAIN ASH	Diseases			
	Fire Blight (bacteria)	General and serious. New shoots suddenly appear as if scorched by fire.	Follow directions for sanitation and chemical control recommended for fire blight of crab apple.	
	Cytospora Canker (fungus)	Most common on weakened or injured trees low in vigor. Irregular cankers often girdle twigs, limbs, or trunk, killing parts beyond.	Prune out and remove cankered parts, in dry weather. Sterilize cuts with disinfectant. Use tree paint on wounds. Maintain vigor by fertilizing in spring. Where serious spray with fungicide.	Benlate Bordeaux Mix
	Insects			
	Mites	See Arborvitae		
	Woolly Apple Aphid	Blackish, soft bodied aphids in white waxy mass covering. Appear on stem, branches and roots.	Thorough coverage is essential when aphids are noted.	malathion diazinon Dursban

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
OAK	Diseases			
	Anthracnose (fungus)	Small, scattered, brown spots along veins, giving leaves a scorched appearance. (Can be confused with non-parasitic leaf scorch.)	Collect and remove diseased leaves. In wet years it may be necessary to use a fungicide spray at time of early leaf break and twice thereafter at 10-day intervals.	Zineb Bordeaux Mix Kocide 101
	Taphrina Leaf Blister (fungus)	Yellow or brown, more or less round, raised blisters on upper leaf surface.	Collect and remove fallen leaves. Spray with fungicide before buds open.	Zineb Captan
	Oak Wilt (fungus)	All oaks susceptible. Leaves turn pale, progressively become more yellowed or bronzed from tips and margins inward. Wilting and dieback. Brown or black streaks in sapwood. Positive identification possible only by laboratory culturing.	Infected trees cannot be cured. Remove and burn all infected and dead oaks as soon as possible.	
	Chlorosis (iron deficiency) (non-parasitic disorder)	Pin and willow oaks susceptible in neutral or alkaline soils. Yellowish-green leaves with darker green veins.	Use 1 to 1 mixture of iron sulfate and sulfur when leaves are expanding. Or iron chelate. Follow manufacturer's directions.	
	Powdery Mildew (fungus)	Whitish, powdery mold on leaves. Leaves may be stunted, distorted, and drop early.	Collect and remove infected leaves. Spray generally not necessary.	Benlate Karathane
	Insects			
	Aphids	Many species feed on the leaves of oak. Some excrete much honeydew.	Spray when aphids are present.	malathion diazinon Dursban
	Galls	A great number of galls are present on oaks. They may appear on leaves, acrons, buds, twigs, roots, bark, and catkins.	If spray is applied, it should usually be applied in the spring when the leaves are about ½ unfolded.	carbaryl (Sevin) malathion

OAK (Cont.)	Insects (Cont.)			
	Golden Oak Scale	Greenish-golden, circular, slightly convex scales in pits in bark of limbs.	A dormant spray using summer oil in early spring. Use other materials when crawlers are present. At least 2 applications 14 days apart.	summer oil carbaryl (Sevin) Spectricide malathion Zectran
	Oak Kermes Scale	Spherical, gall-like scales 3/16 to 1/4 inch in diameter. Overwinter as partially grown nymphs on twigs.	Seldom warrant control. Apply dormant spray using summer oil in early spring. Other materaisl for crawlers in fall.	summer oil carbaryl (Sevin) Spectricide malathion Zectran
	Obscure Scale	Overwinters nymphs under a circular, gray shields, on bark of limbs and trunk.	Dormant spray using summer oil in spring. Other materials against crawlers in late July.	summer oil carbaryl (Sevin) Spectricide Zectran
	Twig Pruner	Adult a longhorn beetle. Larvae sever twigs and fall with them to ground for overwintering.	Collect severed twigs and destroy.	
PINE	Diseases			
	Tip Blight and Needle Cast (fungi)	General and serious. Needles turn olive green, yellow or brown. Drop prematurely. Lower branches usually affected first. Trees may be killed.	Collect and remove diseased twigs and needles in fall. Spray with fungicide - (1) as new growth starts, (2) as needles emerge from sheath, and (3) when needles are 2/3 of mature length.	Benlate Bordeaux Mix Maneb
	Winter Injury (non-parasitic)	Last year's needles turn yellow to reddish-brown and die from tip down. Needles often fall in late spring or summer.	Water trees in late fall especially following drought. Mulch to prevent deep freezing and thawing around roots.	
	Fall Browning	Needles inside the tree turn yellow then brown. More concentrated in some years than others.	Normal shedding of needles.	

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
PINE (Cont.)	Insects			
	Bagworm	See Arborvitae.		
	European Pine Shoot Moth	Adult a rust-red and gray moth. Small larvae overwinter in buds or under pitch. Pupate in late spring.	Treat terminals in mid-April and in mid-July.	diazinon malathion Zectran
	Pine Bark Aphid	Aphid overwinters as adult female under white wax flakes on trunk of tree. Young appear in late April or early May. Several generations during season.	Dormant oil in spring, other material as needed.	superior oil (70 second) lindane malathion diazinon Zectran Dursban
	Pine Needle Scale	See Fir.		
	Sawflies	There are several species of sawflies that feed on the needles of pine. Larvae of most species present from mid-May to early June.	Spray when larvae are present.	Sevimol Zectran
	Zimmerman Pine Moth	Excessive masses of resin on branches and terminals. Adult reddish with waxy white lines. Larvae overwinter in resin masses.	Spray for larval control in mid-April and early September.	lindane Dylox Zectran
PLUM (ornamental)	Diseases			
	Black Knot (fungus)	Widespread. Elongated, rough black swellings on twigs, small branches and sometimes on trunk.	Prune and destroy all infected wood in late winter, making cuts at least 4 - 6 inches below infected area. Apply tree paint to wounds. Apply dormant fungicide spray.	Benlate Bordeaux Mix
	Plum Pockets (fungus)	General following cool rainy spring. Unfolding leaves are curled, swollen, yellow reddish or purplish and leathery. Fruit infections also.	Apply single dormant spray before buds swell in late winter or early spring.	Bordeaux Mix Ferbam Dichlone

PLUM (Cont.) (ornamental)	Insects			
	Scales	See Hawthorn.		
	Leafhoppers	See Crab Apples.		
POPLAR	Diseases			
	Cytospora Canker (fungus)	General and serious. Irregular, rough, discolored, often sunken and cracked cankers on twigs, branches and trunk. Girdled parts die.	Avoid wounding. If practical, prune out cankers on small branches. Treat pruning wounds with tree paint. Water and fertilize to maintain vigor. Control insects.	
	Insects			
	Oyster Shell Scale	See Ash.		
	Leaf Beetles	Grayish-black larvae skeletonize leaves. Beetles gray with black dashes on wing covers, or red with black marks.	Sometimes numerous enough to warrant control.	carbaryl (sevin) Zectran malathion
PRIVET	Diseases			
	Anthracnose (fungus)	Leaves turn pale green, wilt, shrivel and cling to stem.	Cut and remove infected parts. Apply fungicide spray in wet weather. See anthracnose of Ash.	
	Insects			
	Lilac Borer	See Lilac.		
	Privet Thrips	Tiny black and white banded thrips on leaves, cause leaf browning.	Treat when thrips are noted.	carbaryl (Sevin) diazinon malathion
PYRACANTHA (Fire thorn)	Diseases			
	Fire Blight (bacteria)	General and serious. New shoots appear as if scorched by fire. Leaves cling to twigs.	See control measures under Crab Apple.	

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
PYRACANTHA (Cont.)	Diseases (Cont.)			
	Scab (fungus)	Serious in wet seasons. Spots occur on leaves, and fruit turns brown instead of bright orange.	Cut out and remove infected parts. Use fungicide spray, starting early in spring at bud break and 10 to 14 days later at petal fall.	Benlate
	Insects			
	Lace Bug	See Hawthorn.		
	Leaf Crumpler	Dark brown, slightly hairy caterpillars, 1/3 to ½ inch long in tough, curled, cases. Spend winter on host. Pupae late May, moths in June.	Spray in late April	diazinon malathion Zectran
REDBUD	Diseases			
	Botryosphaeria Twig Blight	Twigs die back. Discolored, sunken areas on twigs.	Severely cankered parts should be pruned and destroyed. Sterilize pruning tools between cuts.	
	Insects			
	(Usually no serious insect problems.)			
ROSE	Diseases			
	Black Spot (fungus)	General and serious. Roundish black spots with irregular margins on leaves.	Collect and remove fallen leaves. Start applying fungicide sprays in spring as leaves expand. 10-day intervals.	Benlate Daconil Mancozeb Folpet
	Crown Gall (bacteria)	Small to large hard, rough galls on roots, crown and canes.	Use certified, disease-free stock. Carefully remove and destroy infected plant parts. Avoid wounding. Strict sanitation measures.	

ROSE (Cont.)	Diseases (Cont.)			
	Cankers of Canes (fungus)	Girdling cankers on canes.	Control black spot. Prune out diseased and dead canes.	
	Powdery Mildew	Whitish patches on leaves.	Start fungicide applications in spring as leaves expand, at 10 - 14 day intervals.	Actidione PM Benlate
	Insects			
	Aphids	See Hawthorn.		
	Leafhoppers	See Hawthorn.		
	Leafrollers	Several species may be present. Larvae, usually greenhish and very active. Roll leaves and feed from the roll. Adults are small moths.	Use spray when larvae are present and still small.	diazinon malathion methoxychlor
	Rose Scale	Female scales almost circular, 1/8 inch diameter. White, male scale long and narrow, ridged. Overwinter as egg. Crawlers late May and June.	See Scurfy Scale under Hawthorn.	
	Spider Mite	See Arborvitae.		
SNOWBALL (Viburnum)	Diseases			
	Anthracnose (spot) Leaf Spots (fungi)	Spots of various sizes, shapes and colors.	If necessary, spray weekly with fungicide. See Ash anthracnose.	
	Powdery Mildew (fungus)	White powdery mold on leaves in late summer and fall.	Use fungicide treatment specific for powdery mildew under Rose.	
	Insects			
	Aphid	Small, soft, ash-gray to dark green insects with piercing sucking mouth-parts. Feed on leaves and cause leaves to cup and roll.	Apply sprays in spring when aphids start to roll leaves. Generally does not cause serious damage to plant.	malathion diazinon Dibrom Dursban

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
SPIREA	Diseases			
	Fire Blight (bacteria)	Blossoms blackened. Shoots die back from tip. Dead leaves cling to shoots.	See under Crab Apple.	
	Leaf Spots (fungi)	Various shapes, sizes and colors.	See control of Ash anthracnose.	
	Powdery Mildew (fungus)	Especially in humid, wet weather. White powdery mold on young leaves and shoots. Distorted flowers.	See fungicide treatment for powdery mildew under Rose.	
	Insects			
	Aphid	See Snowball.		
	Leafrollers	See Rose.		
SPRUCE	Diseases			
	Cytospora Canker (fungus)	Widespread and serious, especially on Blue, Colorado and Norway species. Tufts of needles at branch tips turn light gray or brown and die first. Bluish-white resin exudes from bark of drying branches.	Promptly cut out and destroy dying branches and two apparently healthy ones just above, back to trunk or nearest healthy lateral branch. Do not prune in wet weather. Disinfect pruning tools. In addition, spray with fungicide before new growth starts, and repeat 4 - 5 times at 10 - 14-day intervals. Coverage of low branches is very important.	Bordeaux Mix
	Insects			
	Bagworm	See Arborvitae.		
	Pine Needle Scale	See Fir.		

SPRUCE (Cont.)	Insects (Cont.)			
	Spruce Needle Miner	Needles mined, dead and webbed together in masses close to twigs. Overwinter as small larvae in mined needles. Moths grayish, in June.	Spray when larvae are present and small, usually late June.	Sevimol Spectricide
	Spider Mite	See Arborvitae.		
SWEET GUM	Diseases			
	Bleeding Necrosis	Trees "bleed" from bark surface. Resembles oil on bark of trunk and larger branches. Branches die and trees usually die once affected.	Destroy affected trees.	
	Sweet Gum Blight	Leaves dwarfed and fall early. Foliage is thin.	Maintain fertility levels.	
	Insects			
	Leaf Tier	Leaves webbed together and partially skeletonized by yellowish-green larvae.	Spray in June when larvae are present.	Dylox Sevimol
	Pit Forming Scale	Small, soft, yellow insect under shield-like scale on leaves, branches and buds.	Use dormant oil in early spring. Use other insecticides against crawlers on leaves. Usually mid-June and September.	superior oil (70 second) carbaryl (Sevin) Zectran
SYCAMORE	Diseases			
	Anthracnose (fungi)	Serious in wet seasons. First symptoms on young leaves may be mistaken for frost injury. Later light brown spots occur along veins and enlarge to kill entire leaves. Tips of twigs may be killed back.	All fallen leaves and twigs should be removed. Spray as buds begin to swell. In rainy springs two additional sprays may be needed. One when the leaves are half grown, the other two weeks later.	Benlate Bordeaux Mix Kocide 101 Zineb
	Cankerstain (fungi)	Primarily on London Plane Tree. Small cankers with longitudinal cracks and roughened bark on trunk and large limbs. Bluish-black or brown discoloration under bark over the cankers. There is a gradual thinning of leaves as disease progresses.	Disease is spread primarily by pruning tools. Disinfect tools. No control for disease once it is infected.	

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
SYCAMORE (Cont.)	Insects			
	Sycamore Lace Bug	See Hawthorn (Hawthorn Lace Bug).		
TULIP TREE	Diseases			
	Cankers (fungi)	Sunken areas on twigs and branches causes death of end of branch.	Prune and remove infected parts.	
	Leat Spots (fungi)	Many fungi cause leat spots on Tulip Tree.	Removing fallen leaves will generally give satisfactory control.	
	Leaf Yellowing (non-parasitic)	Serious on young trees. Leaves throughout crown turn yellow and drop prematurely.	Response to drought, deep watering will generally correct the condition.	
	Insects			
	Aphid	Small, soft bodied aphids on leaves. Excretes much honeydew.	Treat when aphids are present.	malathion lindane Baytex Dursban
	Tulip Tree Scale	Large, brown, hemispherical scale up to ½ inch in diameter covers soft bodied insect on twigs. Overwinter as immature scales. Young in August.	Use dormant oil in spring. Other materials to control crawlers in August.	Superior oil (70 second) carbaryl (Sevin) Zectran
WILLOW	Diseases			
	Cankers (fungus)	Widespread and serious. Discolored, sunken areas on twigs, branches or trunk. Cause girdling and death of parts.	Cut and remove dead and cankered parts. Use additional measures as suggested under canker of Poplar.	
	Crown Gall (bacteria)	Rough, irregular, overgrowth on roots, branches or trunk, usually near ground line.	Galls on larger trees may be removed surgically, and a wound paint applied to wound. Disinfect tools between cuts. Remove galls during late fall or mid-summer when sap flow is minimal.	

WILLOW (Cont.)	Diseases (Cont.)			
	Leaf Spots, Spot Anthracnose (fungi)	Widespread, but not serious. Small to large round to irregular brown spots on leaves.	Collect and remove fallen leaves. Spray usually not necessary.	
	Insects			
	Aphids	Several species of soft bodied insects suck sap from leaves and trunk.	Treat when aphids are present.	malathion lindane diazinon Dursban
	Leaf Beetles	See Poplar.		
	Oyster Shell Scale	See Lilac.		
	Scurfy Scale	See Hawthorn.		
YEW	Diseases			
	Phytophthora Root and Crown Root (fungus)	Plants usually slowly decline in vigor and die. Brown-colored cortical tissues in the root and crown areas. Often associated with "wet feet."	Maintain good drainage and vigor.	
	Wet Feet (non-parasitic)	Plants turn yellow and brown. Whole plant may die rather rapidly. Usually occurs in spots where moisture has been excessive. Can be complicated by root and crown diseases.	Maintain good drainage. Plant yews in spots that do not get overly wet.	
	Winter Injury (non-parasitic)	Small twigs at end of branches turn yellow to reddish-brown in late winter or early spring, especially on south and southwest sides where plants are exposed. Tips of needles appear scorched.	Shake off heavy snow or ice loads promptly. Protect from drying, winter winds and sun. Grow in protected locations. Apply mulches in late fall.	
	Insects			
	Fletchers Scale	Yellowish-brown to reddish hemispherical scale over soft bodied insects. Eggs in June. Crawlers June and July.	Spray with dormant oil in spring. Other materials for crawlers when present.	superior oil (70 second) carbaryl (Sevin) malathion Zectran

PLANT	PROBLEM	DESCRIPTION	CONTROL	
			Remarks	Pesticide
YEW (Cont.)	Insects (Cont.)			
	Mealybug	Soft bodied, blackish, sucking insect with white waxy covering on twigs and stem.	Use dormant oil in spring. Other materials in late May and late July. Thorough spray coverage is essential.	superior oil (70 second) malathion Dursban Zectran
		LAWN INSECT PESTS		
	Ants	Several species of ground nesting ants dig hols in lawns. Their mounds detract from the beauty of the lawn.	Apply controls when ants are present.	Dursban toxaphene
	Billbugs	Adults gray to black snout beetles. Larvae (Grubs), white, feed on the roots and stems of grass.		Dursban
	Chinch Bug	Bugs about 1/16 inch long, black with white markings. Immatures red with white band, then black with white spots.	Spray when insects are present.	carbaryl (Sevin)
	Cutworms	Several species. Caterpillars dull brown, gray or black, spotted or stripped. Adults are moths. Feed on grass stems and leaves.	Apply spray when cutworms are present.	carbaryl (Sevin)
	Leafhoppers	Many species of black, green, gray or mottled, jumping insects that suck sap from the plants.	Spray when insects are present.	diazinon malathion
	Sod Webworms	Adults are light brown to whitish moths. Larvae dark greenish. Feed on leaves and stems of grass. Overwinter as partially grown larvae.	Spray in early August.	diazinon Dursban trichlorfon (Dylox)
	White Grubs	Adults, May beetles. White, crescent-shaped, brown headed larvae feed on roots of grass.	Make soil application during late July or August.	trichlorfon (Dylox) diazinon

GUIDE TO CHEMICAL CONTROL OF TURFGRASS DISEASES

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Turfgrass diseases are one of the serious and costly reasons for injury and death to grasses used in lawns, golf courses, and other areas where grasses are desired. Parasitic fungi are the major causal agents of lawn diseases, but other organisms such as nematodes and several non-parasitic problems can also be responsible for injury. Lawn insects also cause serious injuries. An accurate diagnosis of the problem is essential to any successful control program.

Fungicides are pesticides that inhibit or kill disease-causing fungi. Depending upon the function desired, fungicides are of two general types: protective-contact fungicides and systemic fungicides. Protective-contact types are applied to the seed, foliage or soil and provide a surface shield against fungus spores. Foliage applications must be made at approximately 7 to 14 day intervals since mowing and watering remove much of the chemical. Uniform coverage of the foliage can be obtained by using a spray volume of about 5 gallons of water per 1000 sq. ft. A spreader-sticker enhances effectiveness. Examples of protective-contact materials are: Captan, Dyrene, Daconil, mancozeb (Fore or Manzate 200), zineb, etc. Systemic fungicides are absorbed and distributed within the plant - destroy established infections and provide longer control. These materials may be drenched into the root zone for movement up into the plant. Examples of systemics include: benomyl (Tersan 1991), Chloroneb (Tersan SP), TBZ (Mertect), Ethazol (Koban), etc. Read and follow label instructions carefully for proper handling and best results.

TURFGRASS DISEASES	TURFGRASSES AFFECTED	NORMAL SEASON AND INTERVAL OF APPLICATION	FUNGICIDE AND RATE/1000 SQ. FT.
SNOW MOLD			
Fusarium Patch (F. nivale) Typhula Blight (T. incarnata, T. itoana)	All turfgrasses	Late fall to mid-spring	Dyrene WP 50% (4-6 oz) or Tersan SP WP 65% (6-9 oz) or Tersan 1991 WP 50% (2 oz)
SEED ROT, SEEDLING BLIGHTS, DAMPING OFF (Several fungus species)	All turfgrasses	Prior to seeding	Seed treatment: Captan 50% WP or Thiram 75% WP (consult label)
		Emergence and 7-10 days later	Early seedling protection: Captan WP 50% (2-4 oz) or Daconil 2787 WP 75% (2-4 oz) or Dyrene WP 50% (2-4 oz) or Folpet (Phaltan) WP 50% (2 oz) or Zineb WP 75% (2-4 oz)
HELMINTHOSPORIUM DISEASES			
Melting out (H. vagans)	Bluegrasses Fescues Ryegrasses	March-June Sept.-Nov (7-14 day intervals)	Select from the following list of fungicides for chemical control of Helminthosporium diseases:
Helminthosporium Leaf Spot (H. sorokinianum)	Bentgrasses Bluegrasses Fescues Ryegrasses	June-August (7-14 day intervals)	Acti-dione-thiram (2-4 oz) or Captan WP 50% (4-6 oz) or Daconil 2787 WP 75% (4 oz) or Dyrene WP 50% (4-6 oz) or Fore WP 80% (4-6 oz) or Manzate 200 WP 80% (4-6 oz) or Tersan LSR WP 80% (4-6 oz) or Zineb WP 75% (4-6 oz)
Zonate eyespot (H. giganteum)	Bentgrasses Bermudagrass Bluegrasses	July-August (7-14 day intervals)	
Red Leaf Spot (H. erythrospilum)	Bentgrasses	April-August (7-14 day intervals)	
Helminthosporium Blight (H. dictyoides)	Fescues Ryegrasses	April-July (7-14 day intervals)	
Brown Blight (H. siccans)	Fescues Ryegrasses	April-June (7-14 day intervals)	
Leaf Blotch (H. cynodontis)	Bermudagrass	April-June (7-14 day intervals)	
FUSARIUM BLIGHT (F. roseum)	Bentgrasses Bluegrasses Fescues Ryegrasses	April-Sept. (7-10 day intervals)	Tersan 1991 WP 50% (6-8 oz) Water turf thoroughly the day prior to application. After application, drench 300 gal. water per 1000 sq. ft. to obtain penetration into root zone.
DOLLAR SPOT (Sclerotinia homoeocarpa)	Bentgrasses Bermudagrass Fescues Ryegrasses Zoysia	May-Nov. (7-10 day intervals) *3 applications only	Acti-dione-thiram (2-4 oz) or Cleary 3336 WP 50% (1 oz)* or Daconil 2787 WP 75% (2-4 oz) or Dyrene WP 50% (2-4 oz) or Fungo 50 WP 50% (1 oz)* or Mertect WP 60% (2 oz) or Tersan 1991 WP 50% (2 oz)*

TURFGRASS DISEASES	TURFGRASSES AFFECTED	NORMAL SEASON AND INTERVAL OF APPLICATION	FUNGICIDE AND RATE/1000 SQ. FT.
BROWN PATCH (Rhizoctonia solani)	Bentgrasses Bermudagrass Bluegrasses Fescues Ryegrasses Zoysia	June-Sept. 5-10 day intervals	Acti-dione-thiram (2-4 oz) or Daconil 2787 WP 75% (4 oz) or Dyrene WP 50% (4-6 oz) or Fore WP 80% (4-6 oz) or Manzate 200 WP 80% (4-6 oz) or Tersan LSR WP 80% (4-6 oz) or Tersan 1991 WP 50% (2-4 oz)
POWDERY MILDEW (Erysiphe graminis)	Bermudagrass Bluegrasses Fescues	May-Nov. 7-14 day intervals *one application only	Acti-dione-thiram (2-4 oz) or Acti-dione TGF (2 oz) or Karathane WD WP 22.5% (¾-1½ oz) or Tersan 1991 WP 50% (2-3 oz)*
RUSTS (Puccinia graminis f., sp. agrostis, P. coronata, P. zoysae)	Bluegrasses, esp. Merion Kentucky Ryegrasses Zoysia, esp. Manhattan	July-Sept. 7-10 day intervals	Acti-dione-thiram (2-4 oz) or Fore WP 80% (2-4 oz) or Manzate 200 WP 50% (2-4 oz) or Tersan LSR WP 80% (2-4 oz) or Thiram WP 75% (2-4 oz) or Zineb WP 75% (2-4 oz)
SMUTS Stripe Smut (Ustilago striiformis) Flag Smut (Urocystis agropyrii	Bentgrasses Bluegrasses, esp. Merion Kentucky Meadow Fescue Red Top Ryegrasses	Early spring before grass growth begins or late fall. One application. After application, drench with 300 gal. water per 1000 sq. ft. to obtain penetration into root zone.	Fungo 50 WP 50% (6 oz) Tersan 1991 WP 50% (6-12 oz)
PYTHIUM BLIGHT (P. aphanidermatum, P. ultimum and others)	Bentgrasses Bermudagrass Bluegrasses Fescues Ryegrasses Zoysia	June-Sept. 5-7 day intervals Use adequate water in fungicide application to obtain penetration.	Koban WP 35% (4 oz) or Tersan SP WP 65%
SLIME MOLDS (Physarum cinereum, Fuligo sp.	All turfgrasses	May-Sept.	Remove by mowing or raking or any of the turfgrass fungicides.
FAIRY RINGS (Several "toad stool" fungi)	All turfgrasses		Treatment of the area with an approved fumigant such as chloropicrin, methyl bromide or formaldehyde. FOLLOW LABEL INSTRUCTIONS CAREFULLY - PROFESSIONAL ASSISTANCE MAY BE NECESSARY.
NEMATODES (Many species)	All turfgrasses	When problem has been determined to be caused by parasitic nematodes, apply an approved nematicide. Mix 1 pint of DBCP (Nemagcer 12.1 EC or Fumazone 86E) with 10 to 15 gallons of water and drench 1000 sq. ft. of turf. Water turf immediately to make sure nematicide penetrates into soil and to prevent toxic effects to grass. Treat in spring and/or fall when soil temperature is above 55° F. Aerifying turf prior to application improves results. Do not apply to newly seeded areas. Do not feed clippings to livestock or graze treated area. FOLLOW LABEL INSTRUCTIONS - PROFESSIONAL ASSISTANCE MAY BE NECESSARY.	
ALGAE	All turfgrasses	When problem has been determined to be algae (usually under wet conditions). Repeat as needed.	Copper Sulfate (1-2 oz) or Fore WP 80% (2-4 oz) or Tersan LSR WP 80% (2-4 oz)
MOSS	All turfgrasses	When problem has been determined to be moss (usually in shaded areas around trees). Repeat as needed.	Ferrous Ammonium Sulfate (16 oz)

The fungicides suggested above have EPA label registration. Trade names are used for simplicity. The University of Missouri does not endorse any materials. The mention of specific products does not warrant or guarantee the standards of these products nor does it imply approval of the products listed to the exclusion of comparable products that may be equally suitable.

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